WHAT IS CLAIMED IS:

1. A method of recanalizing a substantially totally occluded vessel in a subject, comprising steps of:

(a) obtaining an image of the substantially totally occluded vessel using magnetic resonance;

(b) guiding a recanalization device using the obtained image; and

(c) recanalizing the occlusion with the recanalization device.

2. The method of claim 1 wherein obtaining step (a) comprises obtaining an image of an occluded portion of the vessel using magnetic resonance.

3. The method of claim 1 wherein the image includes an indication of a position of the recanalization device with respect to the occluded vessel.

4. The method of claim 3 wherein the image includes an indication of a spatial orientation of the recanalization device with respect to the occluded vessel.

5. The method of claim 1 wherein the image includes an image of the recanalization device.

6. The method of claim 1 wherein recanalizing step (c) comprises:

(c)(i) providing an electrical conductor having a substantially uninsulated distal tip;

(c)(ii) disposing the conductor in the occluded vessel with the distal tip proximate the occlusion; and

(c)(iii) applying an electrical current to the conductor such that the distal tip of the conductor creates heat.

7. The method of claim 6 wherein the electrical current applied to the conductor is a radio frequency current.

8. The method of claim 1 wherein obtaining step (a) comprises:

(a)(i) receiving a magnetic resonance signal with an external receiver located external to the body of the subject;

(a)(ii) generating a map image of the occluded vessel using the signal received by the external receiver;

(a)(iii) receiving a magnetic resonance signal with a first internal antenna positioned within the body of the subject, proximate to the occluded vessel; and

(a)(iv) locally enhancing the map image of the occluded vessel using the signal received by the first internal antenna.

9. The method of claim 8 wherein receiving step (a)(iii) comprises receiving a magnetic resonance signal with a first internal antenna that is integral with the recanalization device.

10. The method of claim 8 wherein receiving step (a)(iii) comprises receiving a magnetic resonance signal with a first internal antenna that is integral with equipment deployed in the vessel to assist in the delivery of the recanalization device to the occlusion.

11. The method of claim 10 wherein the antenna is integral with a guidewire deployed in the vessel to assist in the delivery of the recanalization device to the occlusion.

12. The method of claim 10 wherein the antenna is integral with a catheter deployed in the vessel to assist in the delivery of the recanalization device to the occlusion.

13. The method of claim 8 further comprising a step (a)(v) of:

(a)(v) calculating a position of the recanalization device based upon the magnetic resonance signal received by the first internal antenna.

14. The method of claim 13 further comprising a step (a)(vi) of:

(a)(vi) generating an integrated image of the occluded vessel based upon the map image, the locally enhanced image, and the calculated position of the recanalization device.

15. The method of claim 14 wherein the integrated image comprises a three-dimensional rendering showing the recanalization device and the occluded vessel.

16. The method of claim 14 wherein generating step (a)(iv) comprises:

(a)(vi)(A) generating an integrated image of the occluded vessel based upon the map image and the locally enhanced image; and

(a)(vi)(B) superimposing a symbol on the integrated image at a position representing the calculated position of the recanalization device.

17. The method of claim 8 wherein the magnetic resonance signals comprise radio frequency signals that are representative of the magnetic resonance of atomic particles in a vicinity proximate to the corresponding antenna.

18. The method of claim 8 wherein the first internal antenna comprises an elongated receiver coil having a pair of elongated electrical conductors that are electrically insulated from each other, each conductor having a distal end, the distal ends of the conductors being electrically coupled to each other, and wherein receiving step (a)(iii) comprises positioning the distal ends of the conductors proximate the occlusion.

19. The method of claim 18 further comprising steps of:

(a)(v) receiving a magnetic resonance signal with a second internal antenna comprising first and second elongated electrical conductors, the conductors being electrically insulated from each other and having spaced-apart distal ends, wherein the spaced-apart distal ends are positioned proximate the occlusion to receive the magnetic resonance signal; and

(a)(vi) locally enhancing the map image of the occluded vessel using the magnetic resonance signal received by the second internal antenna.

20. The method of claim 19 wherein the second internal antenna comprises a coaxial cable including the first and second conductors in a coaxial arrangement.

21. The method of claim 19 wherein the second internal antenna comprises a guidewire deployed in the vessel to assist in the delivery of the recanalization device to the occlusion.

22. The method of claim 19 wherein the first internal antenna comprises a catheter deployed in the vessel to assist in the delivery of the recanalization device to the occlusion.

23. The method of claim 8 wherein the first internal antenna comprises first and second elongated electrical conductors that are electrically insulated from each other, each conductor having a distal end, the distal ends of the conductors being electrically coupled to each other via a coil comprised of a helically wound electrical conductor, and wherein receiving step (a)(iii) comprises positioning the coil proximate the occlusion.

24. The method of claim 8 wherein the first internal antenna comprises first and second elongated electrical conductors, the conductors being electrically insulated from each other and having

spaced-apart distal ends, and wherein receiving step (a)(iii) comprises positioning the distal ends of the conductors proximate the occlusion.

25. The method of claim 24 wherein the first internal antenna comprises a coaxial cable including the first and second conductors in a coaxial arrangement.

26. The method of claim 24 wherein the first conductor of the first internal antenna is adapted to function as an ablation wire in addition to its role in receiving the magnetic resonance signal, wherein the first conductor has a substantially uninsulated distal tip and wherein recanalizing step (c) comprises:

(c)(i) disposing the first conductor of the first internal antenna in the occluded vessel with the distal tip proximate the occlusion; and

(c)(ii) applying an electrical ablation current to the first conductor such that the distal tip of the first conductor vaporizes the substance forming the occlusion.

27. The method of claim 26 wherein the first conductor of the first internal antenna is couplable to a magnetic resonance imaging system adapted to produce the image of the occluded vessel and wherein the first conductor of the first internal antenna is further couplable to an ablation power supply adapted to apply the electrical ablation current to the first conductor.

28. The method of claim 27 further comprising a step (d) of:

(d) selectably switching the first conductor of the first internal antenna between the magnetic resonance imaging system and the ablation power supply.

29. The method of claim 26 wherein the first internal antenna comprises a coaxial cable including the first and second conductors in a coaxial arrangement, the first conductor being the center conductor of the coaxial cable.

30. The method of claim 8 wherein receiving step (a)(i) and generating step (a)(ii) are performed prior to guiding step (b) and recanalizing step (c).

31. The method of claim 30 wherein receiving step (a)(iii) and locally enhancing step (a)(iv) are performed real-time during the performance of guiding step (b) and recanalizing step (c).

32. The method of claim 8 wherein locally enhancing step (a)(iv) comprises:

(a)(iv)(A) generating a local image of the occluded vessel using the signal received by the first internal antenna; and

(a)(iv)(B) superimposing the local image on the map image of the occluded vessel generated using the signal received by the external receiver.

33. The method of claim 1 wherein obtaining step (a) comprises:

(a)(i) receiving a magnetic resonance signal with an external receiver located external to the body of the subject;

(a)(ii) generating a map image of the occluded vessel using the signal received by the external receiver;

(a)(iii) receiving a magnetic resonance signal with a first internal antenna positioned within the body of the subject, proximate to the occluded vessel; and

(a)(iv) generating a local image of the occluded vessel using the signal received by the first internal antenna.

34. The method of claim 33 wherein receiving step (a)(iii) comprises receiving a magnetic resonance signal with a first internal antenna that is integral with the recanalization device.

35. The method of claim 33 wherein receiving step (a)(iii) comprises receiving a magnetic resonance signal with a first internal antenna that is integral with equipment deployed in the vessel to assist in the delivery of the recanalization device to the occlusion.

36. The method of claim 35 wherein the antenna is integral with a guidewire deployed in the vessel to assist in the delivery of the recanalization device to the occlusion.

37. The method of claim 35 wherein the antenna is integral with a catheter deployed in the vessel to assist in the delivery of the recanalization device to the occlusion.

38. The method of claim 33 further comprising a step (a)(v) of:

(a)(v) generating an integrated image of the occluded vessel by combining the map image generated in generating step (a)(ii) and the local image generated in generating step (a)(iv).

39. The method of claim 38 wherein generating step (a)(v) comprises superimposing the local image on the map image.

40. The method of claim 33 further comprising a step (a)(v) of:

(a)(v) calculating a position of the recanalization device based upon the magnetic resonance signal received by the first internal antenna.

41. The method of claim 40 further comprising a step (a)(vi) of:

(a)(vi) generating an integrated image of the occluded vessel based upon the map image generated in generating step (a)(ii), the local image generated in generating step (a)(iv) and the calculated position of the recanalization device.

42. The method of claim 41 wherein the integrated image comprises a three-dimensional rendering showing the recanalization device and the occluded vessel.

43. The method of claim 41 wherein generating step (a)(vi) comprises:

(a)(vi)(A) generating an integrated image of the occluded vessel based upon the map image and the local image; and

(a)(vi)(B) superimposing a symbol on the integrated image at a position representing the calculated position of the recanalization device.

44. The method of claim 33 wherein the magnetic resonance signals comprise radio frequency signals that are representative of the magnetic resonance of atomic particles in a vicinity proximate to the corresponding antenna.

45. The method of claim 33 wherein the first internal antenna comprises an elongated receiver coil having a pair of elongated electrical conductors that are electrically insulated from each other, each conductor having a distal end, the distal ends of the conductors being electrically coupled to each other, and wherein receiving step (a)(iii) comprises positioning the distal ends of the conductors proximate the occlusion.

46. The method of claim 45 further comprising steps of:

(a)(v) receiving a magnetic resonance signal with a second internal antenna comprising first and second elongated electrical conductors, the conductors being electrically insulated from each other and having spaced-apart distal ends, wherein the spaced-apart distal ends are positioned proximate the occlusion to receive the magnetic resonance signal; and

(a)(vi) generating a local image of the occluded vessel using the magnetic resonance signal received by the second internal antenna.

47. The method of claim 46 wherein the second internal antenna comprises a coaxial cable including the first and second conductors in a coaxial arrangement.

48. The method of claim 46 wherein the second internal antenna comprises a guidewire deployed in the vessel to assist in the delivery of the recanalization device to the occlusion.

49. The method of claim 48 wherein the first internal antenna comprises a catheter deployed in the vessel to assist in the delivery of the recanalization device to the occlusion.

50. The method of claim 43 further comprising a step (a)(vii) of:

(a)(vii) generating an integrated image of the occluded vessel by combining the map image generated in generating step (a)(ii), the local image generated in generating step (a)(iv) and the image generated in imaging step (a)(vi).

51. The method of claim 33 wherein the first internal antenna comprises first and second elongated electrical conductors that are electrically insulated from each other, each conductor having a distal end, the distal ends of the conductors being electrically coupled to each other via a coil comprised of a helically wound electrical conductor, and

wherein receiving step (a)(iii) comprises positioning the coil proximate the occlusion.

52. The method of claim 33 wherein the first internal antenna comprises first and second elongated electrical conductors, the conductors being electrically insulated from each other and having spaced-apart distal ends, and wherein receiving step (a)(iii) comprises positioning the distal ends of the conductors proximate the occlusion.

53. The method of claim 52 wherein the first conductor of the first internal antenna is adapted to function as an ablation wire in addition to its role in receiving the magnetic resonance signal, wherein the first conductor has a substantially uninsulated distal tip and wherein recanalizing step (c) comprises:

(c)(i) disposing the first conductor of the first internal antenna in the occluded vessel with the distal tip proximate the occlusion; and

(c)(ii) applying an electrical ablation current to the first conductor such that the distal tip of the first conductor vaporizes the substance forming the occlusion.

54. The method of claim 53 wherein the first conductor of the first internal antenna is couplable to a magnetic resonance imaging system adapted to produce the image of the occluded vessel and wherein the first conductor of the first internal antenna is further couplable to an ablation power supply adapted to apply the electrical ablation current to the first conductor.

55. The method of claim 54 further comprising a step (d) of:

(d) selectably switching the first conductor of the first internal antenna between the magnetic resonance imaging system and the ablation power supply.

56. The method of claim 55 wherein the first internal antenna comprises a coaxial cable including the first and second conductors in a coaxial arrangement, the first conductor being the center conductor of the coaxial cable.

57. The method of claim 52 wherein the first internal antenna comprises a coaxial cable including the first and second conductors in a coaxial arrangement.

58. The method of claim 33 wherein receiving step (a)(i) and generating step (a)(ii) are performed prior to guiding step (b) and recanalizing step (c).

59. The method of claim 58 wherein receiving step (a)(iii) and generating step (a)(iv) are performed real-time during the performance of guiding step (b) and recanalizing step (c).

60. An apparatus for imaging an occluded vessel in a subject, comprising:

a magnetic field generator adapted to establish a magnetic field on the subject;

a magnetic field gradient generator adapted to establish gradients in the magnetic field;

a radio frequency (RF) signal generator adapted to emit pulsed RF signals to at least the occluded vessel of the subject;

an external RF receiver adapted to be positioned external to the body of the subject, to receive RF signals emitted from the subject in response to the RF pulses and to provide an output signal in response to the received signals;

a first internal RF antenna adapted to be positioned in the occluded vessel proximate the occlusion, to receive RF signals emitted from the subject in response to the RF pulses and to provide an output signal in response to the received signals;

a controller adapted to receive and process the output signals from the external and internal RF antennas and to produce magnetic resonance (MR) information related thereto; and

a visual display adapted to receive the MR information produced by the processor and to display the MR information as an image of the occluded vessel.

61. The apparatus of claim 60 wherein the first internal RF antenna is associated with a recanalization device adapted to be positioned in the vessel proximate the occlusion and to recanalize the occluded vessel.

62. The apparatus of claim 61 wherein the first internal RF antenna is integral with the recanalization device.

63. The apparatus of claim 61 wherein the internal RF antenna is integral with equipment adapted to be deployed in the vessel to assist in the delivery of the recanalization device to the occlusion.

64. The apparatus of claim 63 wherein the first internal RF antenna is integral with a guidewire adapted to be deployed in the vessel to assist in the delivery of the recanalization device to the occlusion.

65. The apparatus of claim 63 wherein the first internal RF antenna is integral with a catheter adapted to be deployed in the vessel to assist in the delivery of the recanalization device to the occlusion.

66. The apparatus of claim 61 wherein the controller is adapted to calculate the position of the recanalization device based upon the output signals from the first internal RF antenna.

67. The apparatus of claim 66 wherein the visual display is adapted to receive the position information calculated by the controller and to display the position of the recanalization device with respect to the occluded vessel.

68. The apparatus of claim 67 wherein the visual display is adapted to superimpose a symbol on the image of the occluded vessel at a position representing the calculated position of the recanalization device.

69. The apparatus of claim 60 wherein the first internal RF antenna comprises an elongated receiver coil having a pair of elongated electrical

conductors that are electrically insulated from each other, each conductor having a distal end, the distal ends of the conductors being electrically coupled to each other and adapted to be positioned proximate the occlusion.

70. The apparatus of claim 69 further comprising a second internal RF antenna comprising first and second elongated electrical conductors, the conductors being electrically insulated from each other and having spaced-apart distal ends, wherein the spaced-apart distal ends are adapted to be positioned proximate the occlusion to receive RF signals emitted from the subject, the second internal RF antenna adapted to provide an output signal in response to the received signals.

71. The apparatus of claim 70 wherein the second internal RF antenna comprises a coaxial cable including the first and second conductors in a coaxial arrangement.

72. The apparatus of claim 70 wherein the second internal RF antenna comprises a guidewire deployed in the vessel to assist in the delivery of the recanalization device to the occlusion.

73. The apparatus of claim 72 wherein the first internal RF antenna comprises a catheter deployed in the vessel to assist in the delivery of the recanalization device to the occlusion.

74. The apparatus of claim 60 wherein the first internal RF antenna comprises first and second elongated electrical conductors that are

electrically insulated from each other, each conductor having a distal end, the distal ends of the conductors being electrically coupled to each other via a coil comprised of a helically wound electrical conductor, the coil adapted to be positioned proximate the occlusion.

75. The apparatus of claim 60 wherein the first internal RF antenna comprises first and second elongated electrical conductors, the conductors being electrically insulated from each other and having spaced-apart distal ends adapted to be positioned proximate the occlusion.

76. The apparatus of claim 75 wherein the first internal RF antenna comprises a coaxial cable including the first and second conductors in a coaxial arrangement.

77. The apparatus of claim 75 wherein the first conductor of the first internal RF antenna is adapted to function as an ablation wire in addition to its role in receiving the magnetic resonance signal, wherein the first conductor has a substantially uninsulated distal tip adapted to be positioned proximate the occlusion and wherein the first conductor is adapted to receive and conduct an electrical ablation current such that the distal tip of the conductor vaporizes the substance forming the occlusion.

78. The apparatus of claim 77 wherein the first conductor of the first internal RF antenna is couplable to an ablation power supply adapted to apply the electrical ablation current to the first conductor.

79. The apparatus of claim 78 further comprising a switch adapted to selectably switch the first conductor of the first internal RF antenna between the controller and the ablation power supply.

80. The apparatus of claim 77 wherein the first internal RF antenna comprises a coaxial cable including the first and second conductors in a coaxial arrangement, the first conductor being the center conductor of the coaxial cable.

81. The apparatus of claim 60 wherein the controller is adapted to receive the external RF receiver output signal and to produce a first set of MR information related thereto, and to receive the internal RF antenna output signal and to produce a second set of MR information related thereto, and wherein the visual display is adapted to provide a first view of the occluded vessel based on the first set of MR information and to provide a second view of the occluded vessel based on the second set of MR information.

82. The apparatus of claim 81 wherein the visual display is adapted to integrate the first and second views of the occluded vessel to produce an integrated image of the occluded vessel.

83. The apparatus of claim 82 wherein the controller is adapted to calculate the position of the recanalization device based upon the output signals from the first internal RF antenna and wherein the visual display is adapted to receive the position information calculated by the controller

and to display the position of the recanalization device with respect to the occluded vessel in the integrated image.

84. The apparatus of claim 83 wherein the visual display is adapted to superimpose a symbol on the integrated image of the occluded vessel at a position representing the calculated position of the recanalization device.

85. The apparatus of claim 83 wherein the integrated image comprises a three-dimensional rendering showing the recanalization device and the occluded vessel.